

AMENDMENT UNDER 37 C.F.R. § 1.312

Serial Number: 10/789,736

Filing Date: February 27, 2004

Title: TRANSPARENT AMORPHOUS CARBON STRUCTURE IN SEMICONDUCTOR DEVICES

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Dkt: 303.885US1In the Claims

1. (Previously Presented) A method comprising:
forming an amorphous carbon layer for a semiconductor device structure including introducing a carbon-containing process gas and a spreading gas over a wafer, the spreading gas having a composition of helium or a nitrogen containing gas, the spreading gas to spread the process gas across the wafer to form the amorphous carbon layer as a uniform amorphous carbon layer, the amorphous carbon layer having an extinction coefficient between about 0.001 and about 0.15 at a wavelength of 633 nanometers.
2. (Previously Presented) The method of claim 1, wherein the method includes subjecting the process gas and the spreading gas to radio frequency energy to spread a plasma over the wafer, the spreading gas being a gas containing nitrogen.
3. (Previously Presented) The method of claim 1, wherein the method includes providing a nitrogen gas as the spreading gas to form the amorphous carbon layer.
4. (Previously Presented) The method of claim 1, wherein the method includes providing ammonia as the spreading gas to form the amorphous carbon layer.
5. (Currently Amended) The method of claim 1, wherein the method includes providing argon mixed with nitrogen as the spreading gas [[to]] to form the amorphous carbon layer.
6. (Previously Presented) The method of claim 1, wherein the method includes providing helium as the spreading gas to form the amorphous carbon layer.
7. (Original) The method of claim 1, wherein introducing a process gas containing carbon includes introducing one or more gases from C_3H_6 , CH_4 , C_2H_2 , C_2H_4 , C_2H_6 , C_3H_8 , C_3H_4 , and C_4H_{10} .

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8. (Original) The method of claim 1, wherein introducing a process gas containing carbon includes introducing C_3H_4 and/or C_4H_{10} .
9. (Original) The method of claim 1, wherein the method further includes forming the amorphous carbon layer at temperatures ranging from about 150°C to about 500°C.
10. (Original) The method of claim 1, wherein introducing a process gas containing carbon includes introducing a process gas containing carbon and substantially without oxygen.
11. (Original) The method of claim 1, wherein forming an amorphous carbon layer for a semiconductor structure includes forming the amorphous carbon layer as an insulation layer or antireflection layer of the semiconductor structure.
12. (Original) The method of claim 1, wherein introducing a process gas containing carbon includes introducing propylene at a flow rate of between 500 standard cubic centimeters per minute (sccm) and 4000 sccm.
13. (Original) The method of claim 1, wherein the method further includes providing helium at a flow rate of between 200 sccm and 1500 sccm as a spreading gas to spread the process gas over the wafer for the semiconductor structure to form the amorphous carbon layer.
14. (Previously Presented) A method comprising:
forming a masking structure for the processing of an electronic device, the masking structure having an amorphous carbon layer formed by:
introducing a process gas containing carbon;
flowing a spreading gas of helium or a nitrogen containing gas composition, the spreading gas to spread the process gas containing carbon across a wafer; and
subjecting the process gas and the spreading gas to radio frequency energy to spread a plasma over the wafer to form the amorphous carbon layer as a uniform

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amorphous carbon layer, wherein the amorphous carbon layer is formed having an extinction coefficient between about 0.001 and about 0.15 at a wavelength of 633 nanometers.

15. (Original) The method of claim 14, wherein flowing a spreading gas includes flowing a nitrogen gas at a flow rate ranging from about 500 sccm to about 3000 sccm.
16. (Original) The method of claim 14, wherein flowing a spreading gas includes flowing ammonia at a flow rate ranging from about 50 sccm to about 200 sccm.
17. (Original) The method of claim 14, wherein introducing a process gas containing carbon includes introducing one or more gases from C_3H_6 , CH_4 , C_2H_2 , C_2H_4 , C_2H_6 , C_3H_8 , C_3H_4 , and C_4H_{10} .
18. (Original) The method of claim 14, wherein introducing a process gas containing carbon includes introducing a process gas containing carbon that is substantially without oxygen.
19. (Original) The method of claim 14, wherein the method further includes forming the amorphous carbon layer at temperatures ranging from about 150°C to about 500°C.
20. (Original) The method of claim 14, wherein the method further includes forming the amorphous carbon layer of the masking structure as a patterned amorphous carbon layer.
21. (Original) The method of claim 14, wherein forming the masking structure further includes forming a silicon oxynitride layer over the amorphous carbon layer.
22. (Original) The method of claim 21, wherein forming a silicon oxynitride layer over the amorphous carbon layer includes forming the silicon oxynitride layer in situ deposited together with the amorphous carbon layer.

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23. (Original) The method of claim 14, wherein the method further includes removing the masking structure.
24. (Original) The method of claim 23, wherein removing the masking structure includes removing the amorphous carbon using an oxygen plasma process.
25. (Original) The method of claim 14, wherein introducing a process gas containing carbon includes introducing propylene at a flow rate of between 500 standard cubic centimeters per minute (sccm) and 4000 sccm.
26. (Original) The method of claim 14, wherein flowing a spreading gas includes providing helium at a flow rate ranging from about 200 sccm to about 1500 sccm.
27. (Previously Presented) A method for forming an electronic device comprising:
providing a substrate on which one or more circuits are formed; and
forming an amorphous carbon layer for a semiconductor structure during processing of the one or more circuits, forming the amorphous carbon layer including:
introducing a process gas containing carbon; and
providing a spreading gas of helium or a nitrogen containing gas composition to spread the process gas over a wafer to form the amorphous carbon layer as a uniform amorphous carbon layer, wherein the amorphous carbon layer is formed having an extinction coefficient between about 0.001 and about 0.15 at a wavelength of 633 nanometers.
28. (Original) The method of claim 27, wherein the method further includes forming the amorphous carbon layer at temperatures ranging from about 150°C to about 500°C.
29. (Original) The method of claim 27, wherein introducing a process gas containing carbon includes introducing one or more gases of C₃H₆, CH₄, C₂H₂, C₂H₄, C₂H₆, C₃H₈, C₃H₄, and C₄H₁₀.

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30. (Original) The method of claim 27, wherein introducing a process gas containing carbon includes introducing a process gas containing carbon that is substantially without oxygen.

31. (Original) The method of claim 27, wherein providing a spreading gas includes providing one or more gases of helium, nitrogen, ammonia, and argon mixed with nitrogen.

32. (Original) The method of claim 27, wherein forming an amorphous carbon layer for a semiconductor structure includes forming a masking structure having the amorphous carbon layer.

33. (Original) The method of claim 32, wherein forming a masking structure further includes forming a silicon oxynitride layer over the amorphous carbon layer.

34. (Original) The method of claim 32, wherein the method further includes removing the masking structure.

35. (Original) The method of claim 27, wherein forming an amorphous carbon layer for a semiconductor structure includes forming the amorphous carbon layer as a layer in the semiconductor structure of the electronic device.

36. (Original) The method of claim 27, wherein forming an amorphous carbon layer for a semiconductor structure includes forming the amorphous carbon layer as an insulation layer in the semiconductor structure of the electronic device.

37. (Original) The method of claim 27, wherein forming an amorphous carbon layer for a semiconductor structure includes forming the amorphous carbon layer as an antireflection layer in the semiconductor structure of the electronic device.

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38. (Original) The method of claim 27, the method further includes forming an electronic device as an integrated circuit.

39. (Original) The method of claim 27, the method further includes forming a plurality of electronic devices.

40. (Original) The method of claim 27, wherein introducing a process gas containing carbon includes introducing propylene at a flow rate of between 500 standard cubic centimeters per minute (sccm) and 4000 sccm.

41. (Original) The method of claim 27, wherein providing a spreading gas includes providing helium at a flow rate ranging from about 200 sccm to about 1500 sccm.

42. (Previously Presented) A method for forming a memory comprising:
providing a substrate;
processing a semiconductor structure for the memory on the substrate; and
forming an amorphous carbon layer for the semiconductor structure, forming the amorphous carbon layer including:

introducing a process gas containing carbon and a spreading gas of helium or a nitrogen containing gas composition over a wafer, the spreading gas to spread the process gas containing carbon across the wafer; and

maintaining a temperature ranging from about 150°C to about 500°C to form the amorphous carbon layer as a uniform amorphous carbon layer, the amorphous carbon layer having an extinction coefficient between about 0.001 and about 0.15 at a wavelength of 633 nanometers.

43. (Original) The method of claim 42, wherein introducing a process gas containing carbon includes forming providing one or more gases of C₃H₆, CH₄, C₂H₂, C₂H₄, C₂H₆, C₃H₈, C₃H₄, and C₄H₁₀.

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44. (Original) The method of claim 42, wherein introducing a process gas containing carbon includes introducing a process gas containing carbon and substantially without oxygen.

45. (Original) The method of claim 42, wherein the method further includes flowing a spreading gas to spread the process gas over the wafer for the semiconductor structure to form the amorphous carbon layer, the spreading gas including one or more gases of helium, nitrogen, ammonia, and a mixture of argon with nitrogen.

46. (Original) The method of claim 42, wherein forming an amorphous carbon layer for a semiconductor structure includes forming a masking structure having the amorphous carbon layer.

47. (Original) The method of claim 46, wherein forming a masking structure further includes forming a silicon oxynitride layer over the amorphous carbon layer.

48. (Original) The method of claim 46, wherein the method further includes removing the masking structure.

49. (Original) The method of claim 42, wherein forming an amorphous carbon layer for a semiconductor structure includes forming the amorphous carbon layer as a layer in the semiconductor structure of the memory.

50. (Original) The method of claim 42, wherein forming an amorphous carbon layer for a semiconductor structure includes forming the amorphous carbon layer as an insulation layer in the semiconductor structure of the memory.

51. (Previously Presented) A method of forming an electronic system comprising:
providing a controller;
coupling the controller to one or more electronic devices, at least one of the controller or

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one electronic device of the one or more electronic devices is formed by a method that includes forming an amorphous carbon layer for a semiconductor structure, wherein forming the amorphous carbon layer includes:

introducing a process gas containing carbon; and

providing a spreading gas of helium or a nitrogen containing gas composition to spread the process gas over a wafer to form the amorphous carbon layer as a uniform amorphous carbon layer, wherein the amorphous carbon layer is formed having an extinction coefficient between about 0.001 and about 0.15 at a wavelength of 633 nanometers.

52. (Original) The method of claim 51, wherein the method further includes forming the amorphous carbon layer at temperatures ranging from about 150°C to about 500°C.

53. (Original) The method of claim 51, wherein introducing a process gas containing carbon includes forming providing one or more gases of C₃H₆, CH₄, C₂H₂, C₂H₄, C₂H₆, C₃H₈, C₃H₄, and C₄H₁₀.

54. (Original) The method of claim 51, wherein introducing a process gas containing carbon includes introducing a process gas containing carbon that is substantially without oxygen.

55. (Original) The method of claim 51, wherein providing a spreading gas includes introducing one or more gases of helium, nitrogen, ammonia, and argon mixed with nitrogen.

56. (Original) The method of claim 51, wherein forming an amorphous carbon layer for a semiconductor structure includes forming a masking structure having the amorphous carbon layer.

57. (Original) The method of claim 56, wherein forming a masking structure further includes forming a silicon oxynitride layer over the amorphous carbon layer.

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58. (Original) The method of claim 56, wherein the method further includes removing the masking structure.
59. (Original) The method of claim 51, wherein forming an amorphous carbon layer for a semiconductor structure includes forming the amorphous carbon layer as a layer in the semiconductor structure of the at least one of the controller and one electronic device of the one or more electronic devices.
60. (Original) The method of claim 51, wherein forming an amorphous carbon layer for a semiconductor structure includes forming the amorphous carbon layer as an insulation layer in the semiconductor structure of the at least one of the controller and one electronic device of the one or more electronic devices.
61. (Original) The method of claim 51, wherein providing a controller includes providing a processor.
62. – 84. (Canceled)